REMARKS

Claims 1-94 were pending as of the action dated January 27, 2009. Claims 1, 14, 26, 37, 48, 61, 73, and 84 are in independent form.

Reconsideration is respectfully requested in light of the following remarks.

Information Disclosure Statement

Applicants note the Examiner's indication that the references listed on a PTO-1449 form filed on November 12, 2008, have been considered.

Allowable Subject Matter

Applicants note the Examiner's acknowledgement that the prior art does not teach mapping a mapping permutation to a plurality of antennas for a plurality of adjacent tones. Applicants note the Examiner's acknowledgement that claims 13, 25, 36, 47, 60, 72, 83, and 94 would each be allowable if rewritten to include all of the limitations of the base claim and any intervening claims. Accordingly, Applicants reserve the right to rewrite claims 13, 25, 36, 47, 60, 72, 83, and 94 to include all of the limitations of the base claim and any intervening claims to be in allowable form.

Section 103 Rejections

Claims 1-4, 14-17, 26-28, 37-40, 48-51, 61-64, 73-75, and 84-87 were rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Patent No. 6,636,568 ("Kadous") in view of U.S. Patent Application Publication No. 2002/0122383 ("Wu"). On page 4 of the Official Action dated January 27, 2009, the Examiner indicated a rejection under "35 U.S.C. 102(e)". Applicants believe that the rejection under "35 U.S.C. 102(e)" is a typographical error since the Office explicitly uses two separate references. Applicants have interpreted the rejection as under U.S.C. § 103(a), as stated on page 3 of the of the Official Action dated January 27, 2009. Applicants respectfully traverse the rejections.

Claim 1 and its dependent claims

Applicants note the Examiner's acknowledgment that Kadous does not teach applying a plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas. However, Applicants respectfully disagree with the Examiner's assertion that a combination of Kadous and Wu teaches the features of claim 1.

Applicants previously argued that Wu does not teach, for a plurality of data tones, applying a plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas.

The Examiner responded by stating that:

> "… Wu teaches in 1:[0015] of a plurality of data tones, applying the plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas i.e.' .. multiple inputs, multiple output (MIMO) structure has multiple communication channels that are used between transmitters and receivers. A space time transmitter diversity (STTD) system may be used on a MIMO structure i.e. applying the plurality of mapping permutations in an alternating manner, but it will not increase throughput. (Page 2, Office Action dated January 27, 2009) (emphasis added)

Applicants maintain that the Examiner has failed to address the specific language of claim 1, which recites for a plurality of data tones, applying the plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas.

Applicants respectfully submit that claim 1 is allowable for at least this reason.

Furthermore, the portion of Wu relied upon by the Examiner does not teach or suggest a plurality of mapping permutations as recited in claim 1. Claim 1 recites that a spatial multiplexing rate corresponds to the plurality of mapping permutations.

As reproduced above, the Examiner points to a space time transmitter diversity (STTD) system. Applicants respectfully submit that a space time transmitter diversity system does not receive a selected spatial multiplexing rate that corresponds to a plurality of mapping permutations. Time diversity is not the same as spatial diversity, or relevant to the selected

spatial multiplexing rate that corresponds to a plurality of mapping permutations, as recited in claim 1.

In addition, Applicants maintain that, in Wu's system, signals transmitted using spatial diversity and signals transmitted using time diversity are not transmitted at a single rate (i.e., in time diversity, "parallel transmission of data packets can not be done" (Page 2, paragraph 23); in spatial diversity, "signals that are transmitted over multiple ones of the transmitters are independent of each other" (Page 7, claim 1)). Rather, the signals are transmitted at different rates, and not a selected spatial multiplexing rate.

Applicants respectfully submit that claim 1 is allowable for at least these additional reasons.

The Examiner also stated that:

> "Wu also teaches in 1:[0014] of applying the plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of tones i.e. OFDM system, there are many OFDM modes, for examples are the 1 k mode (1024 tones) and the half k mode (5 12 tones). For 1 k mode, the number of sub-carriers is 1024 and for the half k mode, the number of sub-carriers is 512. The 1 k mode is suitable for a channel with long delay and slow temporal fading, while the 512 mode is suitable for the channel with a short delay and fast temporal fading). (Page 2, Office Action dated January 27, 2009)

Applicants respectfully disagree. Paragraph 14 of Wu states that:

> "In a conventional OFDM system, there are many OFDM modes, for examples are the 1 k mode (1024 tones) and the half k mode (5 12 tones). For 1 k mode, the number of sub-carriers is 1024 and for the half k mode, the number of sub-carriers is 512. The 1 k mode is suitable for a channel with long delay and slow temporal fading, while the 512 mode is suitable for the channel with a short delay and fast temporal fading. But which mode will be used is really depending on the real environment. (Page 1, paragraph 14)

Paragraph 14 of Wu describes a conventional OFDM system. In particular, paragraph 14 describes different OFDM modes that operate using different numbers of sub-carriers (i.e., tones). Paragraph 14 does not teach or suggest, for a plurality of tones, applying the plurality of

mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas, which is what claim 1 recites.

For at least these reasons, Applicants submit that claim 1 and its dependent claims are allowable.

Claim 14 and its dependent claims

Claim 14 is directed to a method and includes a plurality of mapping permutations applied in an alternating manner, where the plurality of mapping permutations correspond to a selected spatial multiplexing rate. For at least similar reasons as set forth above with respect to claim 1, claim 14 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claim 26 and its dependent claims

Claim 26 is directed to an apparatus and includes applying a plurality of mapping permutations in an alternating manner, where a selected spatial multiplexing rate corresponds to the plurality of mapping permutations. For at least similar reasons as set forth above with respect to claim 1, claim 26 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claim 37 and its dependent claims

Claim 37 is directed to an apparatus and includes a plurality of mapping permutations applied in an alternating manner, where the plurality of mapping permutations correspond to a selected spatial multiplexing rate. For at least similar reasons as set forth above with respect to claim 1, claim 37 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claim 48 and its dependent claims

Claim 48 is directed to a computer-readable medium and includes applying a plurality of mapping permutations in an alternating manner, where a spatial multiplexing rate corresponds to the plurality of mapping permutations. For at least similar reasons as set forth above with

respect to claim 1, claim 48 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claim 61 and its dependent claims

Claim 61 is directed to a computer-readable medium and includes a plurality of mapping permutations applied in an alternating manner, where the plurality of mapping permutations correspond to a selected spatial multiplexing rate. For at least similar reasons as set forth above with respect to claim 1, claim 61 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claim 73 and its dependent claims

Claim 73 is directed to an apparatus and includes applying a plurality of mapping permutations in an alternating manner, where a selected spatial multiplexing rate corresponds to the plurality of mapping permutations. For at least similar reasons as set forth above with respect to claim 1, claim 73 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claim 84 and its dependent claims

Claim 84 is directed to an apparatus and includes a plurality of mapping permutations applied in an alternating manner, where the plurality of mapping permutations correspond to a selected spatial multiplexing rate. For at least similar reasons as set forth above with respect to claim 1, claim 84 and its dependent claims are allowable over the proposed combination of Kadous and Wu.

Claims 5-12, 18-24, 29-35, 41-46, 52-59, 65-71, 76-82, and 88-93 were rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Kadous in view of Wu, in further view of Gesbert, et al. From Theory to Practice: An Overview of MIMO Space-Time Coded Wireless Systems, IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 21, NO. 3, APRIL 2003, and Rietz, College Algebra pages 186-187, Henry Holt and Company, 1909. Applicants respectfully traverse the rejections.

Claims 5-12

Claims 5-12 depend from claim 1. Applicants note the Examiner's statement that "Gesbert and Reitz are not relied on to cure deficiencies of claim 1, but to complement Kadous and Wu in teaching additional limitations in claim 5". (Page 3, Office Action dated January 27, 2009). Applicants also maintain that Gesbert and Reitz do not cure the deficiencies of Kadous or Wu. Gesbert generally discloses mapping each symbol stream onto one of a multiple transmit antennas. (Page 282, Principles of Space-Time (MIMO) Systems, paragraph 1). And the portion of Rietz relied upon by the Examiner only discloses an algebraic definition for combinations of things all different and not when applied to antennas and tones. (Page 187, Section 134). Therefore, claims 5-12 are submitted to be allowable for at least the same reasons set forth above with respect to claim 1.

The Examiner suggests that Kadous, Wu, Gesbert, and Rietz teach the features of claim 5. In particular, the Examiner restated that:

> Wu teaches of at least two permutations i.e. space time transmitter diversity (STTD) and spatial multiplexing (SM). (Page 3, Office Action dated January 27, 2009)

As stated above, STTD is not a mapping permutation that corresponds to a spatial multiplexing rate. Time diversity is not the same as spatial multiplexing. Therefore, STTD is not a mapping permutation as recited in claim 5, and Wu does not teach or suggest that the plurality of mapping permutations comprise $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas.

Applicants respectfully submit that claim 5 is allowable for at least this additional reason.

Claim 8 recites that the mapping permutations are applied to the plurality of data tones in a cyclical manner.

The Examiner states that:

> Further, in Wu teaches in Figure 3 of mapping these permutations cyclically across a set of tones (frequency) and antennas. Rietz teaches of an algebraic definition of combinations of a subset of all things different when applied to a set of antenna and tones, where Wu's STTD and SM are of two instances. Examiner argues that it would be obvious, as a function channel conditions (also taught by Wu, Abstract), to apply combinations of Rietz in a cyclical manner, as taught by Wu, for permutations between STTD and SM in order to optimize these resources. (Page 3, Office Action dated January 27, 2009)

Applicants respectfully disagree.

Wu's Figure 3 shows a STTD-OFDM encoder. (Page 2, Paragraph 28). Wu's Figure 3 only shows loading a single sample on a single tone. (Page 3, paragraph 48). Wu's Figure 3 does not show mapping permutations applied to a plurality of data tones in a cyclical manner.

Furthermore, Applicants maintain the argument that Rietz only discloses the algebraic definition of combinations of all things different. As an initial matter, Rietz does not teach "of an algebraic definition of combinations of a subset of all things different when applied to a set of antenna and tones", as suggested by the Examiner. Rietz is a college algebra book.

In addition, the proposed combinations do not teach or suggest applying permutations in a cyclical order. Rather, combinations ignore order. The relied upon portion of Rietz does not disclose applying a plurality of mapping permutations to a plurality of data tones in a cyclical manner. Therefore, proposed combination of Kadous, Wu, Gesbert, and Rietz do not teach or suggest the method of claim 5.

Claim 8 is allowable for at least this additional reason.

Furthermore, a portion of Wu relied upon by the Examiner states that:

> Sub-carriers are classified for spatial diversity transmission or for time diversity transmission based on the result of a comparison between threshold values and at least one of three criteria. The criteria includes a calculation of a smallest eigen value of a frequency channel response matrix and a smallest element of a diagonal of the matrix and a ratio of the largest and smallest eigen values of the matrix. (Abstract of Wu) (emphasis added)

Applicants maintain that Wu's system selects spatial diversity transmission or time diversity transmission based on independent comparisons for each sub-carrier and does not apply

mapping permutations to a plurality of data tones in a cyclical manner. Applicants respectfully submit that claim 8 is allowable for at least this additional reason.

Claims 18-24

Claims 18-24 depend from claim 14 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 14.

Claim 18 is separately allowable for at least the following additional reasons. Claim 18 is directed to a method and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 18 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 21 is separately allowable for at least the following additional reasons. Claim 21 is directed to a method and includes a plurality of mapping permutations that are applied to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 21 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claims 29-35

Claims 29-35 depend from claim 26 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 26.

Claim 29 is separately allowable for at least the following additional reasons. Claim 29 is directed to an apparatus and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 29 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 31 is separately allowable for at least the following additional reasons. Claim 31 is directed to an apparatus and includes a coding module that is operative to apply a plurality of mapping permutations to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 31 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claims 41-46

Claims 41-46 depend from claim 37 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 37.

Claim 41 is separately allowable for at least the following additional reasons. Claim 41 is directed to an apparatus and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 41 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 44 is separately allowable for at least the following additional reasons. Claim 44 is directed to an apparatus and includes a plurality of mapping permutations that are applied to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 44 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claims 52-59

Claims 52-59 depend from claim 48 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 48.

Claim 52 is separately allowable for at least the following additional reasons. Claim 52 is directed to a computer-readable medium and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing

rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 52 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 55 is separately allowable for at least the following additional reasons. Claim 55 is directed to a computer-readable medium and includes a plurality of mapping permutations that are applied to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 55 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claims 65-71

Claims 65-71 depend from claim 61 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 61.

Claim 65 is separately allowable for at least the following additional reasons. Claim 65 is directed to a computer-readable medium and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 65 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 68 is separately allowable for at least the following additional reasons. Claim 68 is directed to a computer-readable medium and includes a plurality of mapping permutations that are applied to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 68 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claims 76-82

Claims 76-82 depend from claim 73 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 73.

Claim 76 is separately allowable for at least the following additional reasons. Claim 76 is directed to an apparatus and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 76 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 78 is separately allowable for at least the following additional reasons. Claim 78 is directed to an apparatus and includes a coding module that is operative to apply a plurality of mapping permutations to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 78 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claims 88-93

Claims 88-93 depend from claim 84 and also are submitted to be allowable for at least the same reasons set forth above with respect to claim 84.

Claim 88 is separately allowable for at least the following additional reasons. Claim 88 is directed to an apparatus and includes a plurality of mapping permutations comprising $\binom{M_T}{M} = \frac{M_T!}{M! \times (M_T - M)!}$ mapping permutations, where M is the spatial multiplexing rate and M_T is the number of the plurality of antennas. For at least similar reasons as set forth above with respect to claim 5, claim 88 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Claim 91 is separately allowable for at least the following additional reasons. Claim 91 is directed to an apparatus and includes a plurality of mapping permutations that are applied to a plurality of data tones in a cyclical manner. For at least similar reasons as set forth above with respect to claim 8, claim 91 is allowable over the proposed combination of Kadous, Wu, Gesbert, and Rietz.

Conclusion

By responding in the foregoing remarks only to particular positions taken by the Examiner, Applicants do not acquiesce with other positions that have not been explicitly addressed. In addition, Applicants' arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

Applicants respectfully request that all pending claims be allowed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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